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ANALYSIS OF NIELSEN ORANGE-JUICE SALES

BY

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Introduction

U.S. orange-juice volume sales in grocery stores, doing $4 million or greater business, are hypothesized to be dependent on a number of factors, including the prices of orange juice (OJ), grapefruit juice (GJ), remaining 100% juice (RJ), less-than 100% juice drinks (JD), and other goods, the latter which we measure by the consumer price index (CPI); consumer income (INC); the U.S. population (POP); season of the year; advertising and promotion; and consumer preferences. This analysis provides estimates of the impacts of some of these factors on OJ volume sales. The results are shown in the following tables. For each table, bullet points are provided.

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Table 1

First, we review the Nielsen OJ volume sales in the $4 million-plus grocery stores. Table 1 shows total U.S. OJ volume sales in millions of single-strength-equivalent (SSE) gallons, the U.S. population, per capita OJ gallon sales, and the price of OJ. The data in Table 1 hint that:

- The OJ market obeys the basic law of demand: total and per capita OJ gallon sales tend to be inversely related to price; i.e., gallon sales are low (high) when price is high (low); e.g., the extreme values for 1989-90 versus 1992-93.

- It also appears that per capita gallon sales of OJ may be trending downward, with the variation in the price of OJ being relatively small in the last three seasons, and per capita OJ sales declining. Regression results below support this possibility.

- Declining per capita volume sales may indicate untapped potential to expand OJ sales.

- The U.S. population is increasing at roughly 1% per year; likewise, income, the CPI and a time-trend variable, used in the present analysis to measure changes in consumer preferences, tend to increase over time. To avoid multicollinearity in our regression analysis with respect to these variables, we account for population and the CPI in our equations by specifying per capita volume sales as a function of per capita CPI-deflated disposable income, CPI-deflated prices and other variables, as discussed below.

Table 1. Total and per capita OJ gallon sales in $4 million-plus retail stores.

Season	Total OJ	Population	Per Capita OJ	Price OJ
	million SSE gallon	million	SSE gallon	$ per gallon
1988-89	690.2	247.3	2.79	3.72
1989-90	**628.2**	**249.9**	**2.51**	**4.27**
1990-91	700.7	252.6	2.77	3.67
1991-92	688.9	255.4	2.70	3.84
1992-93	**747.8**	**258.1**	**2.90**	**3.35**
1993-94	740.2	260.7	2.84	3.38
1994-95	741.0	263.3	2.81	3.44

Table 2

Continuing our review, we look at per capita sales for different OJ product categories and competitive juice and juice-drink categories.

- Per capita gallon sales for frozen concentrated orange juice (FCOJ) are declining while per capita gallon sales for not-from-concentrate chilled orange juice (COJ-NFC or NFC for short) are increasing.
- Per capita gallon sales for from-concentrate chilled orange juice (COJ-FC or FC for short) and canned single strength orange juice (CSSOJ) are somewhat flat.
- Per capita gallon sales for (less-than-100%) juice drinks (JD) and other juices, excluding OJ, are increasing, reflecting the growing competition OJ faces in the market.
- The highly competitive-interrelated nature of the market for juice and juice-drink products is accounted for in the present analysis by estimating cross-price relationships between the different OJ product forms and different juices and juice drinks.

Table 2. Per capita gallon sales for selected juices in $4 million-plus retail stores.

Season	FCOJ	COJ-NFC	COJ-FC	CSSOJ	Total OJ	Drinks	Drinks + Other Juice
	SSE gallons per capita						
1988-89	1.17	0.42	1.16	0.03	2.79	2.55	4.30
1989-90	1.02	0.42	1.03	0.03	2.51	2.77	4.59
1990-91	1.11	0.49	1.14	0.03	2.77	2.99	4.74
1991-92	1.03	0.54	1.08	0.03	2.70	3.16	4.86
1992-93	1.01	0.66	1.20	0.03	2.90	3.47	5.16
1993-94	0.91	0.70	1.19	0.03	2.84	3.64	5.40
1994-95	0.83	0.75	1.21	0.03	2.81	3.87	5.57

NOTES: The sum of gallon sales for FCOJ, COJ-NFC, COJ-FC and CSSOJ may not equal that for OJ due to rounding. Drinks are less-than-100% juice products; other juice is 100% juice excluding OJ.

Table 3

As mentioned above, the price of OJ is expected to impact sales. More specifically, we mean the price of OJ relative to the prices of other juice products and other goods. As previously mentioned, we measure prices of other goods by the CPI.

- The CPI has been increasing by about 3% annually in recent years; hence, if the price of OJ increases by less-than (more-than) 3% annually, OJ is relatively less (more) expensive compared to other goods; and we would expect consumers to buy more (less) OJ, all else constant.

- Consumer income is also expected to impact sales. More specifically, we mean the real value of income and focus on real per capita income which we measure by dividing nominal disposable income by the CPI and the U.S. population.

Table 3. Trends in the consumer price index, population and income.

Season	CPI	Population	Disposable Income	Real Per Capita Income
		million	- - - - - - - billion $ per week - - - - - - -	
1988-89	1.24	247.3	72.6	237.5
1989-90	1.30	249.9	77.6	238.6
1990-91	1.36	252.6	81.3	236.8
1991-92	1.40	255.4	86.2	241.0
1992-93	1.44	258.1	90.2	242.4
1993-94	1.48	260.7	95.1	246.5
1994-95	1.52	263.3	100.5	251.4

Table 4

Lets look at the price of OJ closer. In Table 2, we noted the sales trend away from FCOJ and toward COJ. Since FCOJ is much cheaper than COJ, we would expect the overall price of OJ to increase due to this trend, given no changes in retail prices of FCOJ and COJ, and the underlying wholesale prices.

- The price of OJ increased from \$3.32 per SSE gallon in 1993-94:12 (the 12th four-week period in 1993-94) to \$3.43 per gallon in 1994-95:12, an increase of \$.11 per gallon or 3.1%.

- Over this period, the sales trend away from FCOJ and toward COJ continued. If we correct for this trend by weighting the prices of FCOJ, COJ and CSSOJ by the gallon sales for these different product forms in 1993-94:12, we see that, if this trend had not occurred, the price of OJ would have been \$3.37 in 1994-95:12, an increase of \$.05 per gallon or 1.5%. That is, the trend away from cheap FCOJ to expensive COJ caused the OJ price to increase by \$.06 per gallon while the changes in the prices of FCOJ, COJ-NFC, COJ-FC and CSSOJ caused the OJ price to increase by \$.05 per gallon.

- Overall, the prices of retail OJ products (FCOJ, COJ and CSSOJ) really did not increase very much (we will look at this closer below), and if we consider the trend-corrected OJ price increase of 1.5% (for 1994-95:12) along with the general increase in prices in the economy of around 3%, we see that OJ products have actually become relatively cheaper in the last year, contrary to what we might have thought had we focused on the uncorrected OJ price increase of 3.1%.

Table 4. Orange juice prices and the impact of the trend away from FCOJ and toward COJ-NFC and COJ-FC.

Four-Week Period	1993-94	1994-95	
	Weighted by Actual Gallon Sales		Weighted by Gallon Sales in 93-94:12
	\$ per SSE gallon		
1	3.41	3.33	3.31
2	3.42	3.34	3.33
3	3.38	3.37	3.34
4	3.37	3.40	3.36
5	3.40	3.50	3.43
6	3.38	3.49	3.42
7	3.42	3.51	3.43
8	3.42	3.51	3.42
9	3.38	3.47	3.39
10	3.38	3.49	3.41
11	3.34	3.46	3.40
12	3.32	3.43 (3.1%)	3.37 (1.5%)
13	3.34	--	--

NOTES: Weighted price=(p1*g1+p2*g2+p3*g3+p4*g4)/(g1+g2+g3+g4); where p=price, g=gallons and 1,2,3, and 4 stand for FCOJ, COJ-NFC, COJ-FC and CSSOJ. Numbers in parentheses are the percent change from the same four-week period in the previous season. Calculated from un-rounded data as opposed to rounded data in table.

Tables 5, 6, 7, 8, 9 and 10

Tables 5 through 9 show further OJ price details as well as income details, for the last two seasons. The price situation for other juices and juice drinks is also shown in Tables 7 through 9. Tables 5 and 10 show corresponding volume sales.

- Table 5 shows the record volume OJ sales in the last 4 four-week periods, along with nominal and real prices for the overall OJ category. Table 6 shows corresponding data on the CPI, as well as real per capita income. Note that, in 1994-95:12, the nominal OJ price was up 3.1% (Table 5) while the real price (nominal price/CPI) was up .5%, as the CPI was up 2.6% (Table 6). Does this mean that OJ prices worked against the record OJ volume sales in 1994-95:12? Given the above results in Table 4, showing that the OJ price is being strongly influenced by the trend toward COJ and away from FCOJ, we need to look at the situation closer.

- Table 7 shows nominal prices for the OJ product forms, as well as, the other juices and juice-drinks. Table 8 shows the corresponding nominal percentage changes in prices, while Table 9 shows the corresponding real (CPI deflated) price changes.

- Note that, for 1994-95:9 through 1994-95:12, the nominal percentage price changes for the OJ product forms in Table 8 are smaller than the percentage change in the CPI in Table 6, and, hence real OJ prices have decreased as shown in Table 9.

- Given the expectation that real price and volume sales are inversely related, it seems that (declining real) OJ prices have helped in achieving record volume sales, as opposed to negatively impacting sales.

- We also see in Table 9 that the real price of apple juice and the real price of other juices in general (which includes the apple juice price) are up about 11.1% and 7.4% in 1994-95:12. Assuming other juices are substitutes for OJ, these increased prices also contribute, to some extent, to the record OJ volume sales.

- Also, in Table 9, note that the real price of juice drinks is down, working against OJ demand.

- Table 10 shows that gallon sales for other or remaining juices (excluding OJ and GJ) and apple juice (included in the other juice category) have been down since 1994-95:4. These data further support substitution of OJ for other juices as a partial explanation of the record OJ volume shown in Table 5.

- To determine how much prices, income and other factors may have impacted OJ demand, we turn to regression analysis.

Table 5. Orange juice gallon sales, and nominal and real OJ prices.

Season	Four-Week Period	Volume Sales		Nominal Price		Real Price	
		million SSE gal.	% change	$ per gallon	% change	$ per gallon	% change
1993-94	1	59.77	3.7	3.41	-3.0	2.33	-5.5
1993-94	2	63.31	3.8	3.42	-1.1	2.34	-3.5
1993-94	3	59.65	-0.4	3.38	-0.1	2.31	-2.6
1993-94	4	59.03	-5.9	3.37	2.7	2.29	0.2
1993-94	5	56.65	-3.9	3.40	4.3	2.31	1.9
1993-94	6	55.27	-4.8	3.38	5.4	2.29	3.0
1993-94	7	53.16	-3.2	3.42	5.3	2.31	2.8
1993-94	8	53.41	-1.9	3.42	4.2	2.31	1.4
1993-94	9	53.87	-0.3	3.38	1.7	2.27	-1.2
1993-94	10	54.29	0.0	3.38	0.0	2.26	-2.8
1993-94	11	56.14	1.7	3.34	-1.6	2.23	-4.2
1993-94	12	56.37	-0.4	3.32	-1.9	2.22	-4.4
1993-94	13	57.44	-0.8	3.34	-2.1	2.23	-4.7
1994-95	1	59.74	-0.1	3.33	-2.2	2.22	-4.8
1994-95	2	61.66	-2.6	3.34	-2.5	2.22	-5.3
1994-95	3	59.72	0.1	3.37	-0.4	2.23	-3.2
1994-95	4	59.64	1.0	3.40	0.8	2.24	-2.1
1994-95	5	56.20	-0.8	3.50	2.9	2.30	-0.2
1994-95	6	55.62	0.6	3.49	3.3	2.29	0.1
1994-95	7	54.37	2.3	3.51	2.6	2.30	-0.4
1994-95	8	52.39	-1.9	3.51	2.6	2.30	-0.2
1994-95	9	54.70	1.5*	3.47	2.7	2.27	0.1
1994-95	10	56.27	3.6*	3.49	3.2	2.28	0.6
1994-95	11	57.29	2.0*	3.46	3.6	2.26	1.0
1994-95	12	57.04	1.2*	3.43	3.1	2.23	0.5

NOTES: * Record four-week levels. Percent change is the percent change from the same four-week period in the previous season. Calculated from un-rounded data as opposed to rounded data in table. Real price is the nominal price divided by the CPI.

Table 6. Trends in the CPI and real per capita income.

Season	Four-Week Period	CPI		Real Per Capita Disposable Income	
		Base=1 1982-84	% Change		
			- % -	$ per week	% change
1993-94	1	1.46	2.7	243.56	-2.5
1993-94	2	1.46	2.5	242.29	0.6
1993-94	3	1.47	2.5	244.87	1.9
1993-94	4	1.47	2.5	245.31	1.8
1993-94	5	1.47	2.4	244.91	1.1
1993-94	6	1.48	2.3	246.43	1.7
1993-94	7	1.48	2.5	246.39	2.0
1993-94	8	1.48	2.7	246.59	2.4
1993-94	9	1.49	2.9	246.69	2.0
1993-94	10	1.49	2.9	247.13	2.1
1993-94	11	1.49	2.8	248.66	2.7
1993-94	12	1.50	2.6	250.30	3.2
1993-94	13	1.50	2.7	250.38	2.8
1994-95	1	1.50	2.8	251.69	3.3
1994-95	2	1.51	2.9	252.00	4.0
1994-95	3	1.51	2.9	252.17	3.0
1994-95	4	1.52	3.0	251.40	2.5
1994-95	5	1.52	3.1	249.58	1.9
1994-95	6	1.52	3.2	250.47	1.6
1994-95	7	1.52	3.0	250.93	1.8
1994-95	8	1.53	2.9	251.80	2.1
1994-95	9	1.53	2.7	251.67	2.0
1994-95	10	1.53	2.6	251.69	1.8
1994-95	11	1.53	2.6	251.73	1.2
1994-95	12	1.54	2.6	252.05	0.7

NOTES: Percent change is the percent change from the same four-week period in the previous season. Calculated from un-rounded data as opposed to rounded data in table.

Table 7. Nominal prices of selected juices.

Season	Four-Week Period	Nominal Juice Prices								
		FCOJ	NFC	FC	CSSOJ	OJ	GJ	RJ	AJ	JD
		$ per SSE gallon								
1993-94	1	2.75	4.58	3.22	4.41	3.41	4.36	3.98	3.38	3.57
1993-94	2	2.79	4.52	3.24	4.42	3.42	4.24	3.93	3.30	3.53
1993-94	3	2.75	4.57	3.19	4.40	3.38	4.29	3.82	3.15	3.58
1993-94	4	2.69	4.55	3.20	4.35	3.37	4.30	3.84	3.17	3.62
1993-94	5	2.71	4.49	3.22	4.41	3.40	4.34	3.86	3.18	3.62
1993-94	6	2.73	4.50	3.17	4.41	3.38	4.30	3.85	3.14	3.51
1993-94	7	2.75	4.52	3.22	4.42	3.42	4.30	3.93	3.22	3.35
1993-94	8	2.74	4.56	3.20	4.42	3.42	4.32	3.94	3.20	3.25
1993-94	9	2.71	4.53	3.17	4.36	3.38	4.31	3.90	3.19	3.31
1993-94	10	2.68	4.71	3.14	4.38	3.38	4.20	3.89	3.16	3.33
1993-94	11	2.65	4.63	3.11	4.37	3.34	4.16	3.84	3.13	3.47
1993-94	12	2.62	4.63	3.11	4.35	3.32	4.15	3.76	3.04	3.53
1993-94	13	2.67	4.55	3.12	4.33	3.34	4.25	3.88	3.13	3.59
1994-95	1	2.65	4.53	3.11	4.26	3.33	4.25	3.90	3.19	3.58
1994-95	2	2.63	4.59	3.13	4.31	3.34	4.14	3.82	3.13	3.59
1994-95	3	2.68	4.53	3.15	4.31	3.37	4.23	3.82	3.10	3.58
1994-95	4	2.69	4.63	3.16	4.30	3.40	4.28	3.87	3.12	3.58
1994-95	5	2.80	4.67	3.20	4.37	3.50	4.28	3.95	3.20	3.55
1994-95	6	2.79	4.71	3.17	4.37	3.49	4.30	3.97	3.22	3.51
1994-95	7	2.75	4.67	3.22	4.31	3.51	4.25	4.03	3.24	3.35
1994-95	8	2.80	4.63	3.21	4.28	3.51	4.26	4.07	3.29	3.26
1994-95	9	2.77	4.61	3.17	4.10	3.47	4.26	4.10	3.34	3.31
1994-95	10	2.74	4.68	3.19	4.09	3.49	4.28	4.16	3.44	3.36
1994-95	11	2.69	4.72	3.18	4.18	3.46	4.27	4.15	3.45	3.50
1994-95	12	2.65	4.68	3.16	4.18	3.43	4.25	4.15	3.46	3.45

NOTES: GJ=grapefruit juice; RJ=remaining 100% juice excluding OJ and GJ; AJ=apple juice; JD=juice drinks.

Table 8. Nominal juice price changes from previous season.

Season	Four-Week Period	Nominal Juice Prices								
		FCOJ	NFC	FC	CSSOJ	OJ	GJ	RJ	AJ	JD
		% change								
1993-94	1	-2.6	-5.0	-5.0	-4.9	-3.0	-4.0	-4.9	-6.1	0.2
1993-94	2	1.3	-7.2	-3.1	-4.5	-1.1	-3.8	-4.2	-6.6	-0.8
1993-94	3	2.7	-3.7	-2.3	-3.8	-0.1	-3.7	-5.0	-7.8	-0.4
1993-94	4	3.5	-1.9	2.1	-2.2	2.7	-2.9	-4.5	-7.6	0.7
1993-94	5	5.6	-2.6	4.4	0.3	4.3	0.2	-4.0	-6.8	1.1
1993-94	6	7.6	-2.2	5.3	-0.2	5.4	-0.4	-4.3	-7.6	0.6
1993-94	7	5.9	-0.7	6.8	0.0	5.3	-1.4	-3.6	-5.5	1.8
1993-94	8	4.3	0.2	5.6	0.7	4.2	-0.2	-3.1	-5.6	1.1
1993-94	9	1.6	-0.9	2.2	-1.0	1.7	-0.8	-2.2	-3.6	2.2
1993-94	10	-1.1	-0.6	-0.1	-0.4	0.0	-3.6	-3.4	-5.9	1.1
1993-94	11	-1.8	-2.1	-2.9	-1.5	-1.6	-4.5	-2.7	-4.8	1.6
1993-94	12	-2.8	-1.5	-2.3	-1.3	-1.9	-3.7	-3.1	-6.1	1.2
1993-94	13	-3.7	-3.5	-1.9	-2.1	-2.1	-2.8	-3.2	-6.7	-0.3
1994-95	1	-3.4	-1.2	-3.6	-3.4	-2.2	-2.5	-2.2	-5.8	0.3
1994-95	2	-5.5	1.5	-3.7	-2.5	-2.5	-2.3	-2.8	-5.2	1.9
1994-95	3	-2.7	-0.8	-1.4	-1.9	-0.4	-1.3	0.1	-1.7	0.2
1994-95	4	-0.1	1.7	-1.4	-1.3	0.8	-0.6	0.7	-1.6	-1.2
1994-95	5	3.0	3.9	-0.8	-1.0	2.9	-1.3	2.2	0.6	-2.0
1994-95	6	2.2	4.5	0.0	-0.9	3.3	-0.1	3.2	2.7	0.0
1994-95	7	0.3	3.4	0.3	-2.5	2.6	-1.2	2.7	0.9	0.1
1994-95	8	2.1	1.5	0.2	-3.2	2.6	-1.3	3.4	2.8	0.5
1994-95	9	2.2	1.7	0.3	-5.8	2.7	-1.2	5.2	4.8	0.2
1994-95	10	2.2	-0.6	1.7	-6.6	3.2	1.9	6.9	8.9	0.8
1994-95	11	1.6	2.0	2.1	-4.4	3.6	2.8	8.1	10.3	1.0
1994-95	12	1.0	1.1	1.7	-4.0	3.1	2.6	10.3	14.0	-2.3

NOTES: Percent change is the percent change from the same four-week period in the previous season. Calculated from un-rounded data as opposed to rounded data in table.

Table 9. Real juice price changes from previous season.

Season	Four-Week Period	Real Juice Prices								
		FCOJ	NFC	FC	CSSOJ	OJ	GJ	RJ	AJ	JD
		% change								
1993-94	1	-5.2	-7.5	-7.5	-7.4	-5.5	-6.6	-7.3	-8.5	-2.4
1993-94	2	-1.2	-9.5	-5.4	-6.9	-3.5	-6.2	-6.6	-8.9	-3.2
1993-94	3	0.1	-6.1	-4.7	-6.1	-2.6	-6.1	-7.4	-10.0	-2.9
1993-94	4	1.0	-4.3	-0.3	-4.5	0.2	-5.2	-6.8	-9.8	-1.7
1993-94	5	3.2	-4.9	2.0	-2.1	1.9	-2.2	-6.3	-9.0	-1.3
1993-94	6	5.2	-4.4	2.9	-2.4	3.0	-2.6	-6.4	-9.7	-1.7
1993-94	7	3.3	-3.1	4.3	-2.4	2.8	-3.8	-6.0	-7.8	-0.7
1993-94	8	1.6	-2.4	2.8	-1.9	1.4	-2.8	-5.6	-8.0	-1.6
1993-94	9	-1.2	-3.7	-0.7	-3.7	-1.2	-3.6	-4.9	-6.3	-0.7
1993-94	10	-3.9	-3.4	-2.9	-3.2	-2.8	-6.3	-6.1	-8.6	-1.7
1993-94	11	-4.5	-4.7	-5.5	-4.2	-4.2	-7.1	-5.4	-7.3	-1.2
1993-94	12	-5.3	-4.0	-4.8	-3.8	-4.4	-6.2	-5.6	-8.5	-1.4
1993-94	13	-6.2	-6.0	-4.5	-4.7	-4.7	-5.3	-5.7	-9.2	-2.9
1994-95	1	-6.0	-3.9	-6.2	-6.0	-4.8	-5.1	-4.8	-8.3	-2.4
1994-95	2	-8.2	-1.4	-6.4	-5.3	-5.3	-5.0	-5.5	-7.8	-1.0
1994-95	3	-5.5	-3.6	-4.2	-4.7	-3.2	-4.2	-2.7	-4.5	-2.6
1994-95	4	-3.0	-1.2	-4.2	-4.1	-2.1	-3.5	-2.2	-4.4	-4.0
1994-95	5	-0.1	0.8	-3.8	-4.0	-0.2	-4.2	-0.9	-2.4	-4.9
1994-95	6	-0.9	1.3	-3.0	-4.0	0.1	-3.1	0.1	-0.4	-3.1
1994-95	7	-2.6	0.4	-2.7	-5.4	-0.4	-4.1	-0.3	-2.1	-2.9
1994-95	8	-0.8	-1.3	-2.6	-5.9	-0.2	-4.1	0.5	-0.1	-2.3
1994-95	9	-0.4	-0.9	-2.3	-8.2	0.1	-3.7	2.4	2.1	-2.4
1994-95	10	-0.3	-3.1	-0.9	-9.0	0.6	-0.7	4.2	6.2	-1.7
1994-95	11	-1.0	-0.6	-0.5	-6.8	1.0	0.2	5.3	7.5	-1.5
1994-95	12	-1.6	-1.5	-0.9	-6.5	0.5	0.0	7.4	11.1	-4.8

NOTES: Percent change is the percent change from the same four-week period in the previous season. Calculated from un-rounded data as opposed to rounded data in table.

Table 10. Volume sales for other juices (excluding OJ and GJ), apple juice and juice drinks.

Season	Four-Week Period	Volume Sales			% Change		
		RJ	AJ	JD	RJ	AJ	JD
		million SSE gallons			%		
1993-94	1	30.60	15.36	60.79	7.5	10.0	9.5
1993-94	2	32.34	16.77	65.92	9.7	12.1	9.3
1993-94	3	33.72	17.92	65.64	7.9	12.1	7.1
1993-94	4	34.03	17.58	69.27	7.2	10.1	5.5
1993-94	5	33.10	16.85	70.07	8.6	11.1	11.1
1993-94	6	32.71	17.14	75.80	6.6	9.1	7.2
1993-94	7	30.79	15.78	83.30	7.0	11.6	8.9
1993-94	8	30.62	15.68	89.32	7.4	11.9	7.9
1993-94	9	30.63	15.60	82.26	4.9	6.7	2.1
1993-94	10	30.30	15.82	79.38	3.7	9.3	1.3
1993-94	11	32.27	17.07	74.87	4.3	6.8	3.7
1993-94	12	32.58	17.61	69.42	2.8	6.4	5.0
1993-94	13	31.28	16.21	64.52	2.5	4.5	4.3
1994-95	1	31.23	15.88	63.17	2.0	3.4	3.9
1994-95	2	33.15	17.24	66.94	2.5	2.8	1.6
1994-95	3	33.92	18.07	69.42	0.6	0.9	5.8
1994-95	4	33.70	17.23	73.04	-1.0	-2.0	5.4
1994-95	5	32.38	16.20	73.37	-2.2	-3.8	4.7
1994-95	6	30.96	15.50	77.80	-5.3	-9.6	2.6
1994-95	7	29.43	14.67	86.12	-4.4	-7.0	3.4
1994-95	8	28.83	13.88	91.42	-5.8	-11.5	2.4
1994-95	9	29.65	14.16	92.56	-3.2	-9.3	12.5
1994-95	10	29.72	14.09	90.56	-1.9	-11.0	14.1
1994-95	11	30.57	14.73	79.09	-5.3	-13.7	5.6
1994-95	12	30.18	14.72	74.54	-7.3	-16.4	7.4

Table 11

We specify a regression equation for each product form which relates per capita gallon sales to (1) the own price for the OJ product in question, (2) the prices of the other OJ product forms, (3) the price of grapefruit juice, (4) the price of other juice (including apple juice), (5) the price of juice drinks, (6) per capita income, (7) two promotional variables provided by Nielsen, and (8) a time trend for changing consumer preferences. Seasonality is accounted for by 52nd differencing the weekly data, as we have 52 weeks in a season. All prices and per capita income were put in real terms by dividing by the CPI.

- The regression results are shown in Table 11. A double log specification (in gallons per capita, real prices and real per capita income) was used so that the all price and income coefficient estimates are elasticities (indicating the percentage change in gallon sales for a 1% change in the price in question or income).

- The results for prices are as expected; i.e., for each OJ product form, the own-price coefficient estimate is negative while the cross-price coefficient estimates are mostly positive.

- Note that COJ-NFC is about twice as price elastic as FCOJ and COJ-FC.

- Also, income and the trend positively impact COJ-NFC but negatively impact FCOJ, COJ-FC, CSSOJ and the aggregate OJ category. The negative trend results confirm that, except for COJ-NFC, per capita volume sales are declining as suggested in Tables 1 and 2.

- The Nielsen promotional variables work as expected; i.e., they positively impact sales.

Table 11. OLS regression results for OJ retail sales, by product form.[a]

Independent Variable	Coefficient Estimate				
	FCOJ	NFC	FC	CSSOJ	Aggregate OJ
Log Price FCOJ	-0.959125*	0.738264*	0.192293*	0.256085*	
Log Price NFC	0.128406*	-2.003013*	0.402341*	-0.055979	
Log Price FC	0.331131*	-0.111655	-1.057205*	0.016084	
Log Price CSSOJ	0.234065*	-0.640919*	0.199836*	-1.505996*	
Log Price OJ					-0.642729*
Log Price GJ	0.11415**	0.798857*	-0.420812*	0.715515*	-0.001278
Log Price RJ	0.279974*	0.560140*	0.168922*	0.326667*	0.210625*
Log Price JD	0.808039*	0.794948*	-0.299558*	1.182377*	0.226170*
Log Time	-0.182399*	0.180919*	-0.108913*	-0.159358*	-0.093625*
Log Income	-0.851841*	1.045287*	-0.507722*	-1.791149*	-0.040882
% Ab Ad	0.001475*	0.002020*	0.001968*		0.001522*
% Display & Ad	0.003592*	0.002540	0.000859	0.008217**	0.000591
R-Square	0.8751	0.8632	0.9065	0.6616	0.8871

[a] Dependent Variable: log per capita gallon sales.

NOTES: *indicates significant at 10% level. **indicates significant at 20% level.

Table 12

Applying the demand coefficient estimates in Table 11 to the changes in the independent variables, the impacts of the different independent variables on sales are estimated for the last 4 four-week periods, as shown in Table 12.

- First, we consider the impact of changes in prices of all OJ product forms (this involves the own and cross OJ price impacts). The results show that changes in OJ prices have had a strong positive impact on gallon sales of COJ-NFC (and CSSOJ) in the last 4 four-week periods; underlying this result is the relatively large own-price elasticity estimate for COJ-NFC shown in Table 11 and the real price decreases for the different OJ product forms shown in Table 9. The impact on the overall OJ category is also positive when we base it on the coefficient estimates for the four disaggregated categories (FCOJ, COJ-NFC, COJ-FC, and CSSOJ).

- Next, recalling the price increases in Table 9 for other juices, note that the aggregate cross-price impact (for the other juices and juice-drink products prices) is positive for the overall OJ category. This is a result of the positive cross-price impact on COJ-FC.

- We also see that, despite the positive impact on COJ-NFC, income and time are negatively impacting the overall OJ category.

- Finally, Table 12 shows that ab ads and displays with ads have been down somewhat and have, hence, worked against recent OJ sales.

Table 12. Decomposition of independent variable impacts, based on OLS regression results in Table 11.

Season	Four-Week Period	Juice					
		OJ	FCOJ	NFC	FC	CSSOJ	OJ Error
		% change					
		OJ Prices: Own/Cross					
1994-95	9	1.83	-3.01	10.58	-0.23	13.49	0.55
1994-95	10	1.43	-2.37	12.61	-2.22	15.52	2.15
1994-95	11	0.18	-1.42	2.02	0.28	10.63	1.67
1994-95	12	0.88	-0.10	6.39	-1.65	9.98	-0.02
		Cross Prices: GJ, RJ, JD					
1994-95	9	0.02	-1.26	-1.98	2.21	-3.33	
1994-95	10	0.42	-0.80	-0.43	1.80	-2.08	
1994-95	11	1.05	-0.29	1.90	1.55	-0.58	
1994-95	12	0.59	-2.02	-0.04	2.98	-3.70	
		Time & Income					
1994-95	9	-1.14	-3.84	4.37	-2.31	-5.34	
1994-95	10	-1.19	-3.65	4.12	-2.19	-4.97	
1994-95	11	-0.98	-2.93	3.18	-1.76	-3.49	
1994-95	12	-0.95	-2.79	3.01	-1.67	-3.23	
		Advertising					
1994-95	9	-0.64	-1.62	0.12	-0.40	0.00	
1994-95	10	-0.13	-1.11	0.98	-0.01	-0.20	
1994-95	11	-0.69	-1.62	-0.17	-0.30	0.21	
1994-95	12	-0.20	-1.02	0.17	0.13	0.00	

NOTES: Estimates for the OJ category are based on the estimates for the disaggregated categories—FCOJ, COJ-NFC, COJ-FC, and CSSOJ.

Tables 13 and 14

To determine whether there has been a recent shift in demand for OJ, presumably due to FDOC advertising, dummy variables for the recent 4 four-week periods were added to our regression equations. Our data are weekly so we use two sets of dummies—one set with dummies for each of the last 16 weeks and the other set with dummies for each of the last 4 four-week periods. The regression results are shown in Table 13.

- For the equation which treats OJ as an aggregate category, the two sets of dummy-variable results show that all dummies except one were positive. This supports a OJ demand shift. Three dummy estimates for the 4 four-week periods are nearly significant at the 10% level, and the dummy estimate for 1994-95:12 is significant at the 20% level (these would be considered weakly significant results by many statisticians).

- The 4 four-week period dummy variables were also added to the disaggregated OJ demand equations. The results are shown in Table 14. These results, show negative or no demand shifts for FCOJ and CSSOJ, and positive demand shifts for both COJ product categories. These results suggest that the negative trend in FCOJ and CSSOJ may be speeding up; hopefully, we are not seeing negative FDOC advertising effects on these categories.

- The positive dummy coefficient results for the COJ categories also could be interpreted as a speeding up of the positive time trend for COJ, due, hopefully, to FDOC advertising. Of course, these dummy-variable results could reflect something else like brand advertising or a change in consumer trends reflecting increased demand for convenience.

- Nevertheless, the results here support the claim that our FDOC advertising is increasing the demands for COJ and the aggregate OJ category; but our results do not support demand increases for FCOJ and CSSOJ.

- Overall, this analysis indicates that the increases in COJ and OJ demands are due to (a) the above mentioned demand shifts which FDOC advertising supports, (b) lower real OJ prices and (c) higher other juice prices.

- In our October outlook report, we indicated that higher OJ prices (due to reduced OJ supplies) could be expected to eventually slow retail OJ sales. The most recent Nielsen data are for the four-week period ending November 4, 1995, and do not cover enough time to reflect the impact of the higher OJ prices we expect to eventually occur at the retail level.

Table 13. OLS regression for OJ retail sales with dummy variables for recent weeks.[a]

Independent Variable	Weekly Dummies		Four-Week Dummies	
	Coefficient Estimate	Prob>|t|	Coefficient Estimate	Prob>|t|
Log Price OJ	-0.644042	0.0001	-0.642917	0.0001
Log Price GJ	0.003398	0.9457	0.001448	0.9764
Log Price RJ	0.186284	0.0001	0.187865	0.0001
Log Price JD	0.271913	0.0242	0.274924	0.0202
Log Time	-0.091783	0.0001	-0.091529	0.0001
Log Income	-0.111189	0.3965	-0.108521	0.4001
% Ab Ad	0.001549	0.0001	0.001548	0.0001
% Display & Ad	0.000630	0.4513	0.000703	0.3891
Dummy Variables				
D33 or DW9	0.028044	0.3739	0.024464	0.1215
D34 or DW10	0.014179	0.6532	0.036063	0.0219
D35 or DW11	0.034256	0.2766	0.025435	0.1056
D36 or DW12	0.020879	0.5073	0.020509	0.2051
D37	0.034557	0.2730		
D38	0.047609	0.1310		
D39	0.016031	0.6104		
D40	0.046098	0.1443		
D41	-0.003112	0.9213		
D42	0.041520	0.1899		
D43	0.023943	0.4473		
D44	0.039413	0.2110		
D45	0.025400	0.4255		
D46	0.004236	0.8938		
D47	0.040581	0.2005		
D48	0.011943	0.7066		

[a] Dependent Variable: log per capita OJ gallon sales.

NOTES: D33-D48 are dummies variables with D33=1 if week 33 in 1994-95, otherwise D33=0, etc. DW9-DW12 are dummies variables with D9=1 if four-week period 9 in 1994-95, otherwise D9=0, etc.

Table 14. OLS regression results for OJ retail sales, by product form, with dummy variables for recent weeks.[a]

Independent Variable	Coefficient Estimate			
	FCOJ	NFC	FC	CSSOJ
Log Price FCOJ	-0.923552*	0.710671*	0.172313*	0.278450*
Log Price NFC	0.124744*	-2.000072*	0.405534*	-0.057495
Log Price FC	0.330834*	-0.117213	-1.068619*	0.048186
Log Price CSSOJ	0.133048	-0.515471*	0.297357*	-1.711420*
Log Price GJ	0.156170*	0.741164*	-0.457249*	0.789985*
Log Price RJ	0.301705*	0.535204*	0.151237*	0.355132*
Log Price JD	0.711735*	0.897942*	-0.272597*	1.180406*
Log Time	-0.202782*	0.202291*	-0.096214*	-0.184595*
Log Income	-0.811263*	1.012938*	-0.537900*	-1.705095*
% Ab Ad	0.001332*	0.002051*	0.001864*	
% Display & Ad	0.004290*	0.003726	0.000368	0.006559
Dummy Variables				
DW9	-0.019391	0.021676	0.023222*	-0.084433**
DW10	-0.008895	0.031701	0.026994*	-0.063189**
DW11	-0.040711*	0.039256	0.030768*	-0.044991*
DW12	-0.044277*	0.048512**	0.006168	0.006826

[a] Dependent Variable: log per capita gallon sales.

NOTES: *indicates significant at 10% level. **indicates significant at 20% level. DW9-DW12 are dummies variables with D9=1 if four-week period 9 in 1994-95, otherwise D9=0, etc.